Chaff mixed with radar weather echoes

Steve Vasiloff, NSSL/NWS-WRH

1. Introduction

Chaff is frequently released by military aircraft in the desert area west of the Great Salt Lake. The chaff is seen on the radar as narrow bands of high reflectivity that travel with the winds. The bands are also very shallow and are usually seen on only one tilt of the radar.

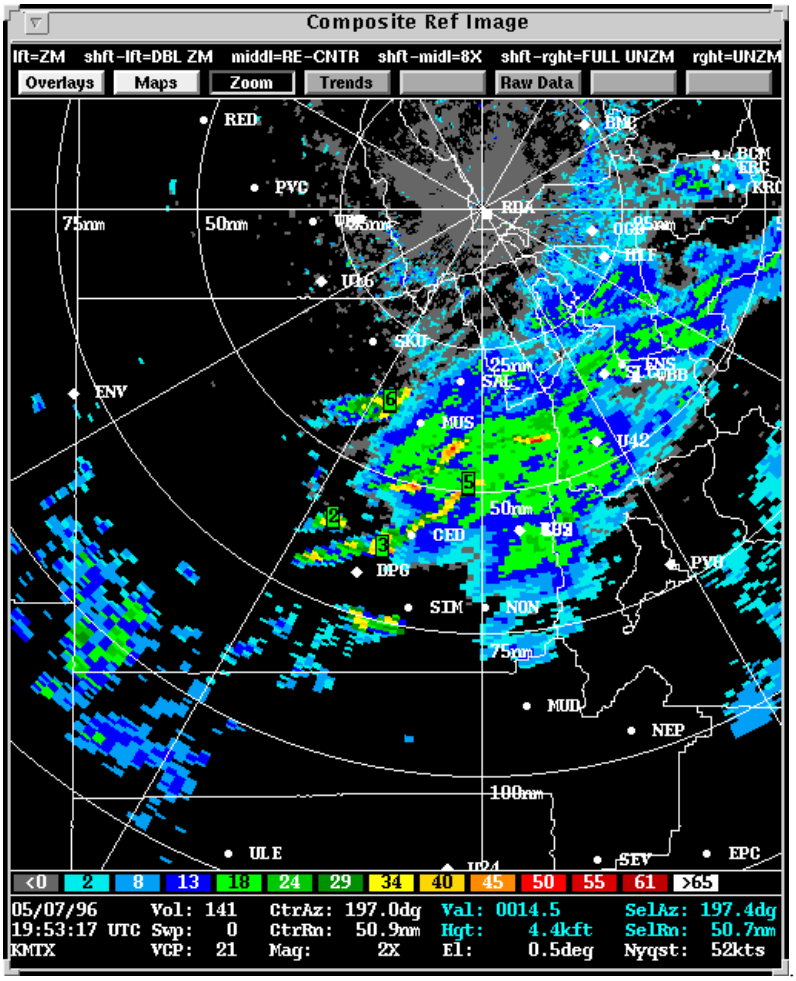
This TA LITE shows what happens when the chaff gets mixed in with real weather echoes. On this day, there were a few bands of weak reflectivity with virga and sporadic light rain. In the case presented here, the chaff blended with several weather echoes causing them to become indistinguishable from actual higher-reflectivity cells. It is hypothesized that this occurred because of turbulent dispersion in the convective cells with which the chaff mixed.

In addition, the "hybrid" echoes were detected by NSSL experimental algorithms. During one volume, a 60% probability of hail was indicated by the NSSL hail detection algorithm. It is important to note here that there are many adaptable parameters in the algorithms that may prevent these types of false detections.

2. Data

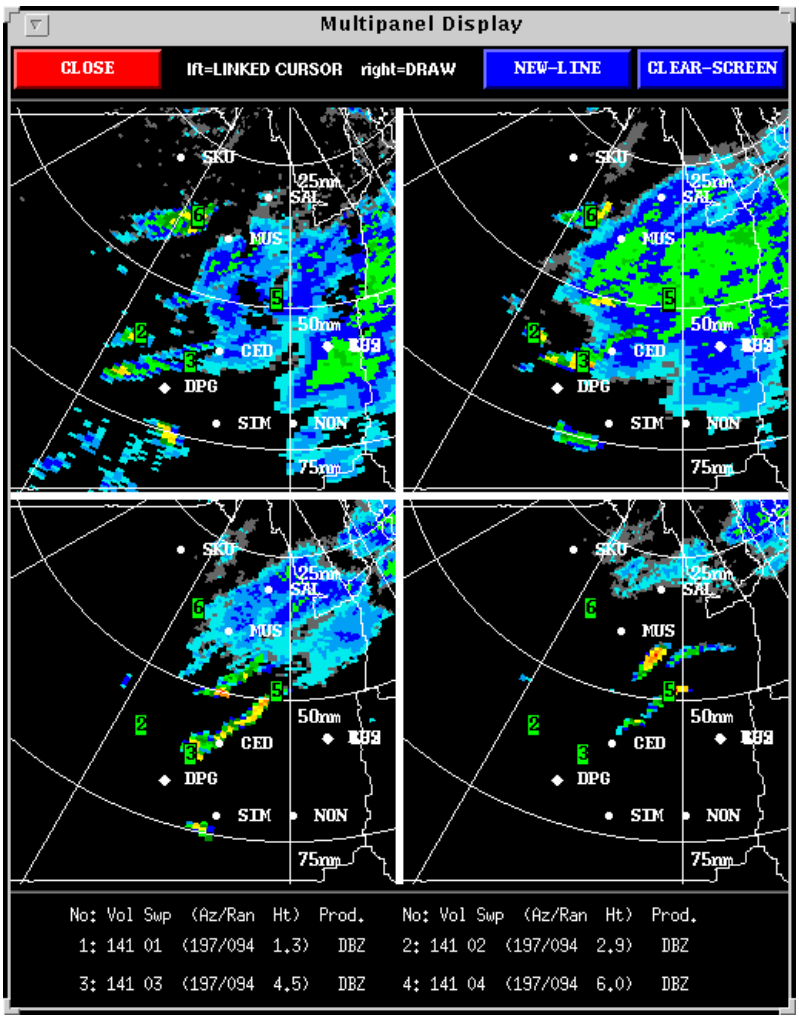
On this day, there were a few bands of weak reflectivity with virga and some light rain. The composite reflectivity at 1953 UTC from the KMTX radar is shown in Fig. 1. The chaff is seen on the radar as narrow bands of high reflectivity. Echoes from weather echoes presumed to be free of chaff, can be seen to the southwest at 100 nm range. We will see that as these cell grow, they have a very similar appearance as some of the chaff-infected echoes.

FIGURE 1. Composite reflectivity image at 1953 UTC on 7 May 1996.



A 4-panel display of reflectivity at 0.5 deg (top-left), 1.5 deg (top right), 2.4 deg (bottom left), and 3.4 deg (bottom right) is shown in Fig. 2. The 6.0 deg tilt shows the typical elongated chaff structure n the absence of background weather echoes. Sometimes these echoes can stretch for hundreds of miles. Note the cell number icons generated by the NSSL cell identification algorithm.

FIGURE 2. Multiple-panel at 1953 UTC showing reflectivity at 0.5, 1.4, 2.4 and 3.4 degrees.



Some of the hybrid echoes triggered NSSL's hail detection algorithm. As seen in the cell table from NSSL's radar algorithm display system (RADS; Fig. 3), there is a 60% probability of any size hail for cell 5 this volume scan. (For more information about NSSL algorithms and RADS please reply via the e-mail tool at the bottom.)

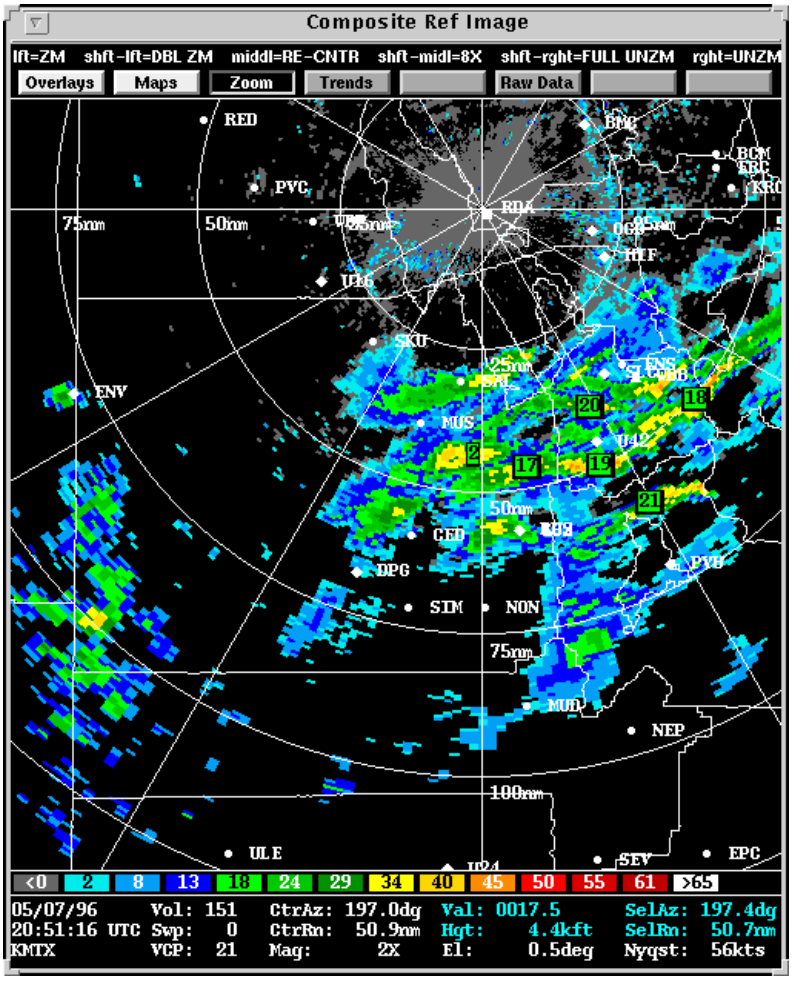
FIGURE 3. Cell table from NSSL's RADS at 1953 UTC

NSSL Cell Algorithm Output for Volume 141

CELLID	AZ	RAN	CIRC	BURST	SVRH	SIZE	HAIL	VIL	MAXZ	HT MXZ	BASE	TOP	DIR/SP	SREH	COUNTY
5	183	48			0%	<1.00	60%	3	46	19	14	19			
3	196	61			0%	<1.00	0%	4	46	13	13	18	256/45		
2	206	60			0%	<1.00	0%	3	43	12	6	12	245/31		
6	206	37			0%	<1.00	0%	2	41	3	3	7			

Figure 4 illustrates the similar appearance of the weather-only and the chaff-infected echoes. At 2051, most of the chaff was exiting the east part of the radar domain. However, the entrainment/influx of the chaff into radar echoes, along with turbulent diffusion, has resulted in what appears to be genuine weather echoes to the south of the radar (e.g., cell number 2). Aside from obvious range effects on the resolution volume, the reflectivity values and more-rounded structure are very similar to echoes developing to the southwest at 100 nm range. One note of doubt is the prospect that the echoes to the south actually increased in intensity. However, there were no obvious differences between the observed precipitation from 25 and 45 dBZ echoes. Eventually, all of the chaff appeared to have exited the area and the reflectivity values dropped to "pre-chaff" values.

FIGURE 4. Composite reflectivity image at 2051 UTC



3. Discussion

Chaff from aircraft is easily identifiable immediately after it is released, even if it mixes with weaker radar echoes (at least for convective weather). This is because of the chaff's locally-intense reflectivity, often greater than 50 dBZ, as well as the elongated structure. With time, however, turbulent diffusion may cause some chaff to linger in the storm cells creating the appearance of a genuine weather echo.

steven.vasiloff@noaa.gov